Fluctuating Pressure Environments and Hydrodynamic Radial Force Mitigation for a Two Blade Unshrouded Inducer

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May 2011

Abstract

Fluctuating pressure data from water flow testing of an unshrouded two blade inducer revealed a cavitation induced oscillation with the potential to induce a radial load on the tubopump shaft in addition to other more traditionally analyzed radial loads. Subsequent water flow testing of the inducer with a rotating force measurement system confirmed that the cavitation induced oscillation did impart a radial load to the inducer. After quantifying the load in a baseline configuration, two inducer shroud treatments were selected and tested to reduce the cavitation induced load. The first treatment was to increase the tip clearance, and the second was to introduce a circumferential groove near the inducer leading edge. Increasing the clearance resulted in a small load decrease along with some steady performance degradation. The groove greatly reduced the hydrodynamic load with little to no steady performance loss. The groove did however generate some new, relatively high frequency, spatially complex oscillations to the environment.